P2

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/902,453	07/10/2001	Jeffrey Glenn Manni	CLOG-P01-002	5474

28120 7590 03/10/2005

FISH & NEAVE IP GROUP
ROPES & GRAY LLP
ONE INTERNATIONAL PLACE
BOSTON, MA 02110-2624

EXAMINER	
MAK, ROBIN C	

ART UNIT	PAPER NUMBER
2674	

DATE MAILED: 03/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 09/902,453	Applicant(s) MANNI ET AL.
	Examiner Robin Mak	Art Unit 2674

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 July 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *04/05/2002*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because on line 1, "imagning" should be replaced by --imaging--. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. **Claims 1, 2, 7, 13, 16, and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jorke (US 6,283,597) in view of Eden et al. (hereinafter "Eden"; US 4,599,730).

4. As pertaining to **claim 1**, Jorke teaches a bandwidth-enhanced laser imaging system (see Fig. 5) comprising: a plurality of lasing elements (lasers B1, G1, R1, B2, G2, R2), each lasing element emitting a laser beam with a center wavelength λ_{0i} and a spectral bandwidth $\Delta\lambda_i$ (each laser inherently having a wavelength and spectral bandwidth corresponding to either red, green, or blue, respectively), wherein the center wavelength of at least one of the lasing elements is wavelength-shifted with respect to the center wavelength of at least one other lasing element (for example, the blue laser has a wavelength that is shifted with respect to the wavelength of the green laser), and

imaging optics (beam unification 32 and 32', and beam expander and condenser 30 and 30'), wherein the combined laser beams have an ensemble spectrum Λ (the combined laser beams will inherently have a combined or "ensemble" spectrum). It is well known in the art that the center wavelengths for RGB light are approximately 610-630 nm for red, 520-540 nm for green, and 450-470 nm for blue. Taking the "at least one lasing element" to be the red (for example 620 nm) and blue (for example 460 nm) lasers, and the "at least one other lasing element" to be the green laser (for example 530 nm), then the mean wavelength shift of the red and blue lasers is 10 nm from the wavelength of the green lasers (i.e., $[(620 + 460)/2] - 530 = 10$ nm).

Jorke fails to explicitly teach that the combined laser beams have an overlap parameter $\gamma \geq 1$, wherein γ equals a mean spectral bandwidth of the lasing elements divided by a mean wavelength shift between the center wavelengths of the at least one and the at least one other lasing elements.

Eden (see abstract) teaches green lasers having a full width of half maximum (equivalent to "spectral bandwidth") of approximately 15 nm. These lasers have the benefit of being continuously tunable. Because these lasers are continuously tunable, these lasers can be tuned or slightly modified to the red and blue wavelengths, which are of close proximity in the spectrum to green wavelengths.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use lasers having a spectral bandwidth of 15 nm, as taught by Eden, in the laser imaging system of Jorke, in order to achieve a system having continuously tunable and adjustable laser sources, thereby increasing device customizability. In doing so,

wherein the mean spectral bandwidth is approximately 15 nm and wherein the mean wavelength shift is approximately 10 nm, then the overlap parameter γ is 15/10, which is greater than 1.

5. As pertaining to **claim 2**, Jorke, as applied to claim 1, teaches a modulator (34 and 34') illuminated with the combined laser beams and receiving image control signals to form a projected laser image (col. 8, line 51 – col. 9, line 22).

6. As pertaining to **claim 7**, Jorke, as applied to claim 1, teaches that the lasing elements emit a primary color selected from the group consisting of R, G, and B (see Fig. 5, components 12 and 12').

7. As pertaining to **claim 13**, Jorke (see Fig. 5) teaches an illuminator for laser projection imaging with reduced speckle, comprising: a plurality of lasing elements (lasers B1, G1, R1, B2, G2, R2), with each lasing element defining a laser beam with a center wavelength λ_{0i} and a spectral bandwidth $\Delta\lambda_i$ (each laser inherently having a wavelength and spectral bandwidth corresponding to either red, green, or blue, respectively), and a beam homogenizer (beam unification 32 and 32', and beam expander and condenser 30 and 30') that images the laser beams of the plurality of lasing elements on a common imaging surface (projection surface 20), wherein the imaged laser beams define an ensemble spectrum Λ (the combined laser beams will inherently have a combined or "ensemble" spectrum). It is well known in the art that the center wavelengths for RGB light are approximately 610-630 nm for red, 520-540 nm for green, and 450-470 nm for blue. Taking the mean center wavelengths to be 620 nm for red, 530 nm for green, and 460 nm for blue, then the mean spectral separation between

the center wavelengths is at most 10 nm (i.e., the mean center wavelengths for each color is at most 10 nm from either the upper or lower boundary – for example, 620 nm is 10 nm from either 610 nm or 630 nm).

Jorke fails to explicitly teach that the ensemble spectrum of the imaged laser beams have a spectral overlap parameter $\gamma \geq 1$, wherein γ equals a mean spectral bandwidth of the lasing elements divided by a mean spectral separation between the center wavelengths.

Eden (see abstract) teaches green lasers having a full width of half maximum (equivalent to "spectral bandwidth") of approximately 15 nm. These lasers have the benefit of being continuously tunable. Because these lasers are continuously tunable, the wavelength of these lasers can be tuned or slightly modified to the red and blue wavelengths, which are of close proximity in the spectrum to green wavelengths.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use lasers having a spectral bandwidth of 15 nm, as taught by Eden, in the laser imaging system of Jorke, in order to achieve a system having continuously tunable and adjustable laser sources, thereby increasing device customizability. In doing so, wherein the mean spectral bandwidth is approximately 15 nm and wherein the mean wavelength shift is approximately 10 nm, then the overlap parameter γ is 15/10, which is greater than 1.

8. As pertaining to **claim 16**, Jorke (see Fig. 5) teaches a laser illumination source for a bandwidth-enhanced laser imaging system, comprising: laser means (lasers B1, G1, R1, B2, G2, R2) emitting laser radiation with a spectral bandwidth at a plurality of

spaced-apart laser wavelengths (each laser inherently having a wavelength and spectral bandwidth corresponding to either red, green, or blue, respectively), and beam combining means (beam unification 32 and 32') for combining the laser radiation to illuminate a common area (projection surface 20). It is well known in the art that the center wavelengths for RGB light are approximately 610-630 nm for red, 520-540 nm for green, and 450-470 nm for blue. Taking the mean center wavelengths to be 620 nm for red, 530 nm for green, and 460 nm for blue, then the difference between the space-apart wavelengths averaged over the laser means is at most 10 nm (i.e., the mean center wavelengths for each color is at most 10 nm from either the upper or lower boundary – for example, 620 nm is 10 nm from either 610 nm or 630 nm).

Jorke fails to explicitly teach that the spectral bandwidth averaged over the laser means is greater than a difference between the spaced-apart wavelengths averaged over the laser means.

Eden (see abstract) teaches green lasers having a full width of half maximum (equivalent to "spectral bandwidth") of approximately 15 nm. These lasers have the benefit of being continuously tunable. Because these lasers are continuously tunable, the wavelength of these lasers can be tuned or slightly modified to the red and blue wavelengths, which are of close proximity in the spectrum to green wavelengths.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use lasers having a spectral bandwidth of 15 nm, as taught by Eden, in the laser imaging system of Jorke, in order to achieve a system having continuously tunable and adjustable laser sources, thereby increasing device customizability. In doing so,

wherein the mean spectral bandwidth is approximately 15 nm and wherein the mean wavelength shift is approximately 10 nm, then the overlap parameter γ is 15/10, which is greater than 1.

9. As pertaining to **claim 17**, Jorke (see Fig. 5) teaches a method of producing bandwidth-enhanced laser radiation, comprising: producing a plurality of laser beams (via lasers B1, G1, R1, B2, G2, R2), each laser beam having a center wavelength λ_{0i} and a spectral bandwidth $\Delta\lambda_i$ (each laser inherently having a wavelength and spectral bandwidth corresponding to either red, green, or blue, respectively), wherein the center wavelength of at least one of the laser beams is wavelength-shifted with respect to the center wavelength of at least one other laser beam (for example, the blue laser has a wavelength that is shifted with respect to the wavelength of the green laser), and combining the respective laser beams into a spatially overlapping beam (via beam unification 32 and 32'), wherein the spatially overlapping beam has an ensemble spectrum Λ (the combined laser beam will inherently have a combined or "ensemble" spectrum). It is well known in the art that the center wavelengths for RGB light are approximately 610-630 nm for red, 520-540 nm for green, and 450-470 nm for blue. Taking the "at least one lasing element" to be the red (for example 620 nm) and blue (for example 460 nm) lasers, and the "at least one other lasing element" to be the green laser (for example 530 nm), then the mean wavelength shift of the red and blue lasers is 10 nm from the wavelength of the green lasers (i.e., [(620 + 460)/2] – 530 = 10 nm).

Jorke fails to explicitly teach that the ensemble spectrum of the spatially overlapping beam has an overlap parameter $\gamma \geq 1$, wherein γ equals a mean spectral

bandwidth of the laser beams divided by a mean wavelength shift between the center wavelengths of the at least one and the at least one other laser beams.

Eden (see abstract) teaches green lasers having a full width of half maximum (equivalent to "spectral bandwidth") of approximately 15 nm. These lasers have the benefit of being continuously tunable. Because these lasers are continuously tunable, the wavelength of these lasers can be tuned or slightly modified to the red and blue wavelengths, which are of close proximity in the spectrum to green wavelengths.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use lasers having a spectral bandwidth of 15 nm, as taught by Eden, in the laser imaging system of Jorke, in order to achieve a system having continuously tunable and adjustable laser sources, thereby increasing device customizability. In doing so, wherein the mean spectral bandwidth is approximately 15 nm and wherein the mean wavelength shift is approximately 10 nm, then the overlap parameter γ is 15/10, which is greater than 1.

10. **Claim 3** is rejected under 35 U.S.C. 103(a) as being unpatentable over Jorke in view of Eden and applicant's admitted prior art (admission).

11. As pertaining to **claim 3**, Jorke, as applied to claim 2, teaches all the limitations presently claimed with the exception of teaching that the overlap parameter is selected so as to reduce speckle in the projected laser image.

Admission teaches that speckle in a laser projection system is reduced when the spectral bandwidth is in the range from 5-15 nm (pg. 2, line 14 – pg. 3, line 19). It is

well known in the art that it is desirable to reduce speckle so as to improve image quality.

It would have been obvious to someone of ordinary skill in the art at the time of invention to adjust and tune the laser sources in order to reduce speckle, in order to improve the quality of the projected image. Furthermore, wherein the laser sources of Jorke/Eden output laser light having spectral bandwidths of approximately 15 nm and wavelengths of 620 nm for red, 530 nm for green, and 460 nm for blue, then the projected laser image will naturally have reduced speckle, as taught by admission.

12. **Claims 4, 5, 8, and 9** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jorke in view of Eden and Gibeau et al. (hereinafter "Gibeau"; US 5,715,021).

13. As pertaining to **claims 4, 5, and 9**, Jorke, as applied to claim 1, teaches that the lasing elements are arranged in a common emission plane (see Fig. 5). Jorke/Eden thus teaches all the limitations presently claimed with the exception of teaching that the lasing elements are semiconductor diode lasers forming a two-dimensional array.

Gibeau teaches an image projection system (see Fig. 1) wherein the lasing elements (104, 106, and 108) comprise a two-dimensional array of semiconductor diode lasers (col. 12, lines 26-39).

It would have been obvious to someone of ordinary skill in the art at the time of invention to utilize an array of semiconductor diode lasers, as is taught by Gibeau, in the laser imaging system of Jorke/Eden, because semiconductor lasers are relatively inexpensive and easy to produce. Furthermore, by using an array of these lasers, it is

possible to achieve a less error-prone imaging system, as each color generated relies on a plurality of laser elements and not on a single laser.

14. As pertaining to **claim 8**, Eden, as applied to claim 1, teaches that the lasing elements emit optical radiation in the UV range (see abstract). Jorke/Eden thus teaches all the limitations presently claimed with the exception of teaching an optical frequency converter pumped by the lasing elements.

Gibeau (Fig. 6, component 710 and claim 1) teaches an image projection system comprising an optical frequency converter for multiplying the frequency of the laser beams.

It would have been obvious to someone of ordinary skill in the art at the time of invention to include an optical frequency converter, as taught by Gibeau, in the laser imaging system of Jorke/Eden, in order to realize laser light of different harmonics, thereby achieving a more customizable imaging system.

15. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Jorke in view of Eden and Hargis et al. (hereinafter "Hargis"; US 6,154,259).

16. As pertaining to **claim 6**, Jorke, as modified by Eden, teaches all the limitations presently claimed with the exception of teaching that the ensemble spectrum has a bandwidth between 1 and 10 nm.

Hargis teaches a laser projection system, wherein the laser sources have a bandwidth of less than 1 nm (col. 9, lines 48-57). Taking these laser sources to have a

bandwidth of just less than 1 nm (for example 0.9 nm), then a plurality of these lasers (for example 3) will have a combined bandwidth of between 1 nm and 10 nm.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use in the laser imaging system of Jorke/Eden, individual laser sources having low bandwidths (for example 0.9 nm), as taught by Hargis, in order for the combined laser beam of Jorke/Eden to have a similarly low bandwidth (of between 1 nm and 10 nm), thereby improving laser color characteristics.

17. **Claim 10** is rejected under 35 U.S.C. 103(a) as being unpatentable over Jorke in view of Eden, Gibeau, and Karakawa (US 6,304,237).

18. As pertaining to **claim 10**, Jorke, as modified by Eden and Gibeau, teaches all the limitations presently claimed with the exception of the optical frequency converter being either OPO, SHG, SFG, periodically-poled and quasi-phase-matched nonlinear optical structures.

Karakawa teaches an RGB laser light source display system comprising an optical frequency converter that is either an OPO or an SHG (col. 3, line 61 – col. 4, line 9).

It would have been obvious to someone of ordinary skill in the art at the time of invention to use an SHG optical frequency converter, as taught by Karakawa, as the optical frequency converter in the laser imaging system of Jorke/Eden/Gibeau, in order to realize laser light of the second harmonic.

19. **Claims 11 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jorke in view of Eden and Ohtsuki et al. (hereinafter "Ohtsuki"; US 6,590,698).

20. As pertaining to **claims 11 and 12**, Jorke, as applied to claim 1, teaches that the imaging optics includes a beam unification component (32 and 32') and a condenser lens (30 and 30') providing for uniform illumination (col. 8, line 65 – col. 9, line 13). Jorke/Eden thus teaches all the limitations presently claimed with the exception of teaching that the bean unification component is an integrating fly-eye lens.

Ohtsuki teaches a laser apparatus comprising an integrating fly-eye lens (col. 42, lines 12-37) used as an integrator for a laser beam to improve illumination uniformity.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use an integrating fly-eye lens, as taught by Ohtsuki, as the bean unifying component of Jorke/Eden, in order to further improve the illumination characteristics of the projected laser beam.

21. **Claims 14 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hargis in view of Eden.

22. As pertaining to **claim 14**, Hargis (see Figs. 11 and 12) teaches a bandwidth-enhanced RGB laser projection system with reduced speckle, comprising: three illuminators (155, 156, and 157) associated with a respective R, G, and B channel and producing R, G, and B illumination, a beam combiner (combiner 171) for combining the R, G, and B illumination, and projection optics (projection lens 166) for projecting the combined R, G, and B illumination on a projection display (projection screen 167),

wherein at least one of the R, G, and B illuminators comprises a plurality of lasing elements (arrays 152, 153, and 154), each lasing element emitting a laser beam with a center wavelength λ_{0i} and a spectral bandwidth $\Delta\lambda_i$ (each laser inherently having a wavelength and spectral bandwidth corresponding to either red, green, or blue, respectively), wherein the center wavelength of at least one of the lasing elements is wavelength-shifted with respect to the center wavelength of at least one other lasing element (for example, the blue laser has a wavelength that is shifted with respect to the wavelength of the green laser), and imaging optics (152, 153, and 154) that combines the respective laser beams to form the R, G, or B illumination, wherein the combined laser beams have an ensemble spectrum Λ (the combined laser beams will inherently have a combined or "ensemble" spectrum). It is well known in the art that the center wavelengths for RGB light are approximately 610-630 nm for red, 520-540 nm for green, and 450-470 nm for blue. Taking the "at least one lasing element" to be the red (for example 620 nm) and blue (for example 460 nm) lasers, and the "at least one other lasing element" to be the green laser (for example 530 nm), then the mean wavelength shift of the red and blue lasers is 10 nm from the wavelength of the green lasers (i.e., [(620 + 460)/2] – 530 = 10 nm).

Hargis fails to explicitly teach that the ensemble spectrum of the combined laser beams have an overlap parameter $\gamma \geq 1$, wherein γ equals a mean spectral bandwidth of the lasing elements divided by a mean wavelength shift between the center wavelengths of the at least one and the at least one other lasing elements.

Eden (see abstract) teaches green lasers having a full width of half maximum (equivalent to "spectral bandwidth") of approximately 15 nm. These lasers have the benefit of being continuously tunable. Because these lasers are continuously tunable, the wavelength of these lasers can be tuned or slightly modified to the red and blue wavelengths, which are of close proximity in the spectrum to green wavelengths.

It would have been obvious to someone of ordinary skill in the art at the time of invention to use lasers having a spectral bandwidth of 15 nm, as taught by Eden, in the laser imaging system of Hargis, in order to achieve a system having continuously tunable and adjustable laser sources, thereby increasing device customizability. In doing so, wherein the mean spectral bandwidth is approximately 15 nm and wherein the mean wavelength shift is approximately 10 nm, then the overlap parameter γ is 15/10, which is greater than 1.

23. As pertaining to **claim 15**, Hargis, as applied to claim 14, teaches respective modulators (131), each modulator illuminated with one of the R, G, and B illumination and responsive to image control signals corresponding to the respective R, G, or B channel (col. 10, lines 29 – col. 11, line 42).

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Robin Mak whose telephone number is 571-272-7694. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Edouard can be reached on 571-272-7603. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RM
4 February 2005

ALEXANDER EISEN
PRIMARY EXAMINER
TECHNOLOGY CENTER 2600